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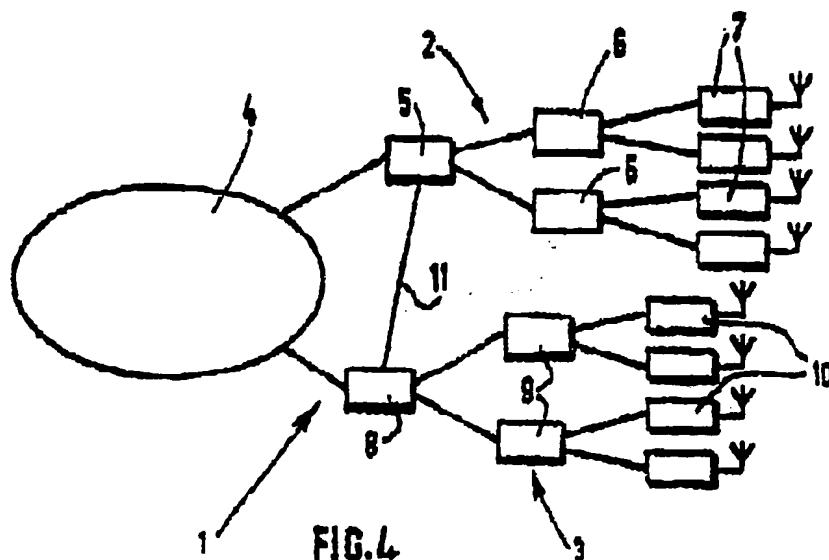
United Kingdom

## (54) Mobile radiotelephony combining cellular and local cordless systems

(57) Calls are routed between an ordinary telephone network (4) and subscriber mobile telephone terminals either by ports (7) of a cellular telephony network (2) or by ports (10) of a local telephony (cordless/telepoint) network (3). To make an outgoing call from a mobile terminal, contact is firstly sought with a local telephony port (10); subscriber chooses between making the call under local telephony or under cellular telephony.

The cellular and cordless networks may be linked, with an attempt being made to route a call to a mobile first via the cordless network, and failing to locate the mobile, via the cellular network.

A mobile telephone terminal having cellular and cordless transmitter/receivers sharing a common antenna is proposed. The terminal may monitor both networks even when a call is being made on one of them. Automatic logging may be possible.



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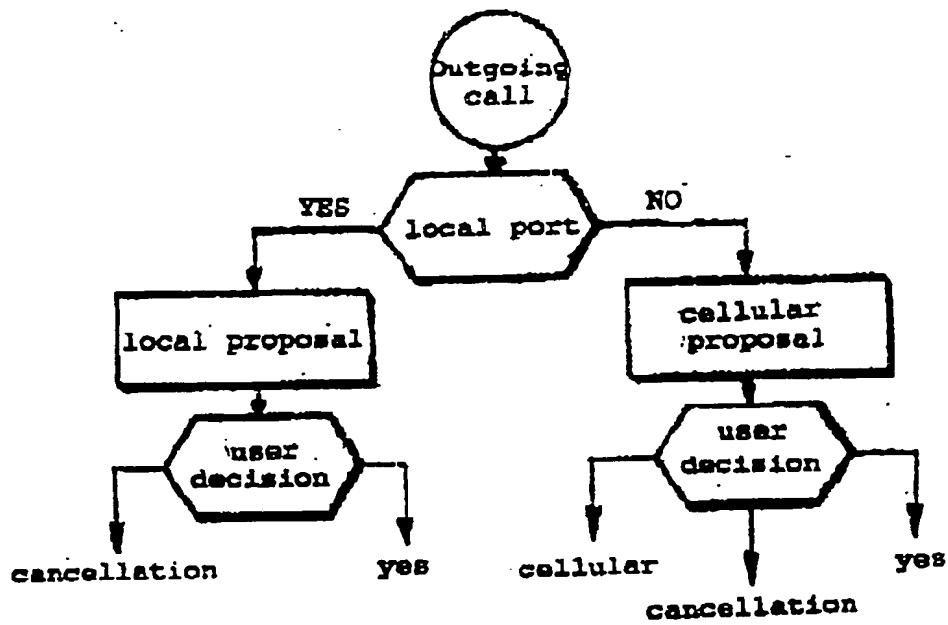


FIG.1

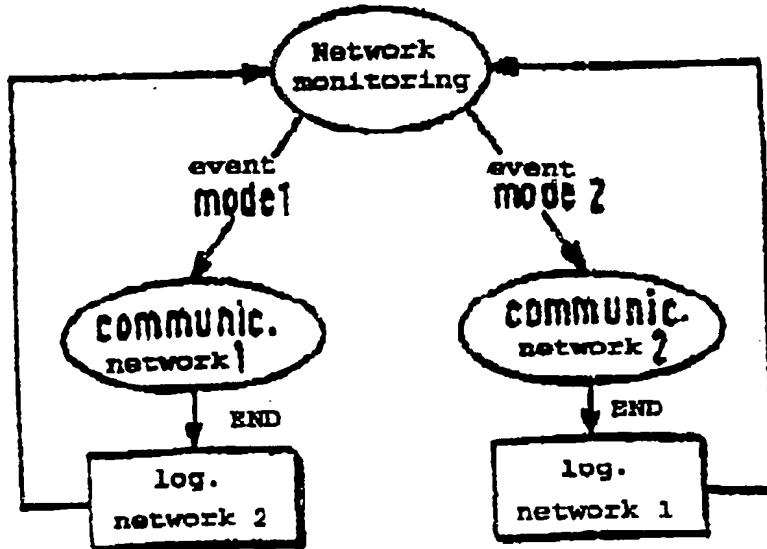


FIG.2

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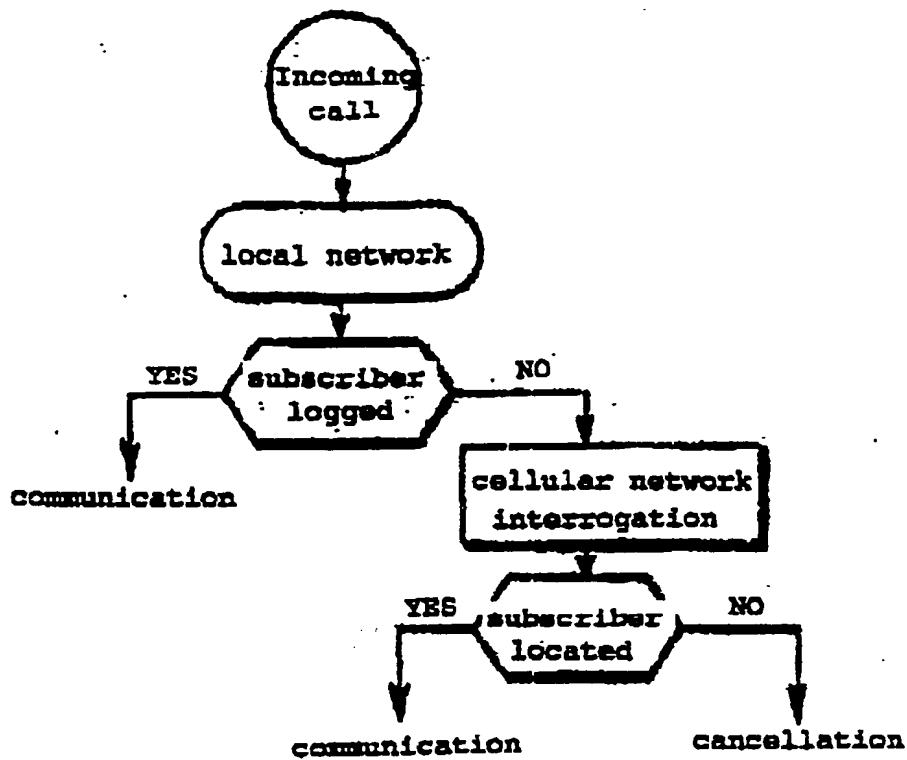
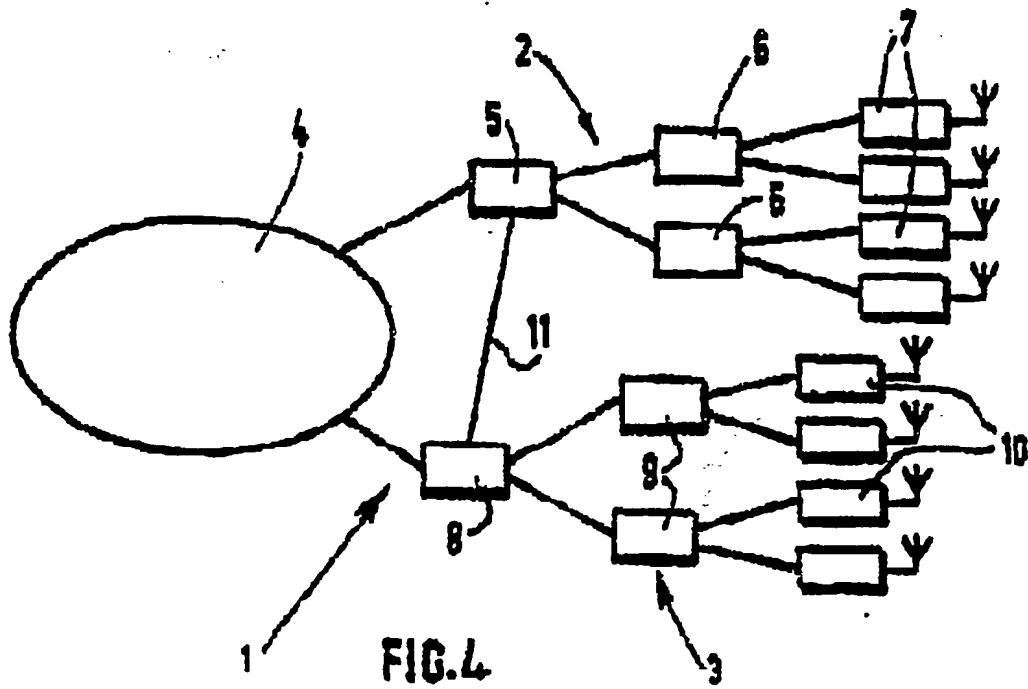


FIG.3



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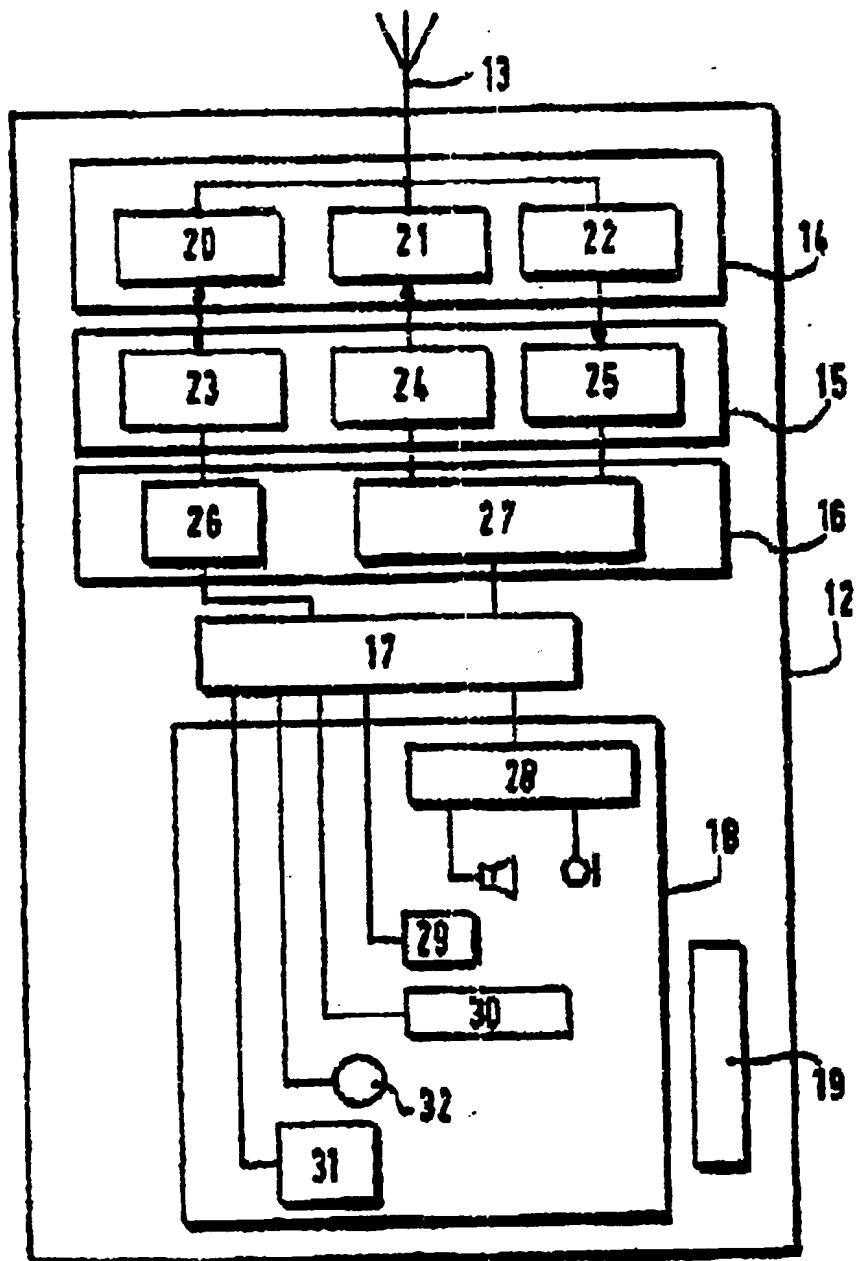


FIG. 5

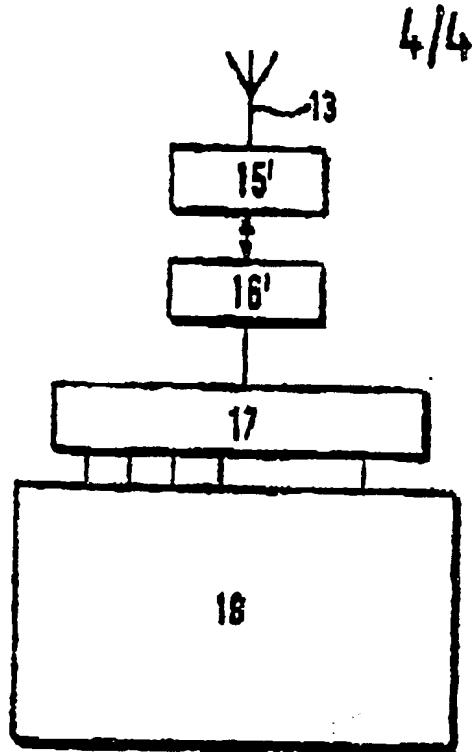


FIG.6

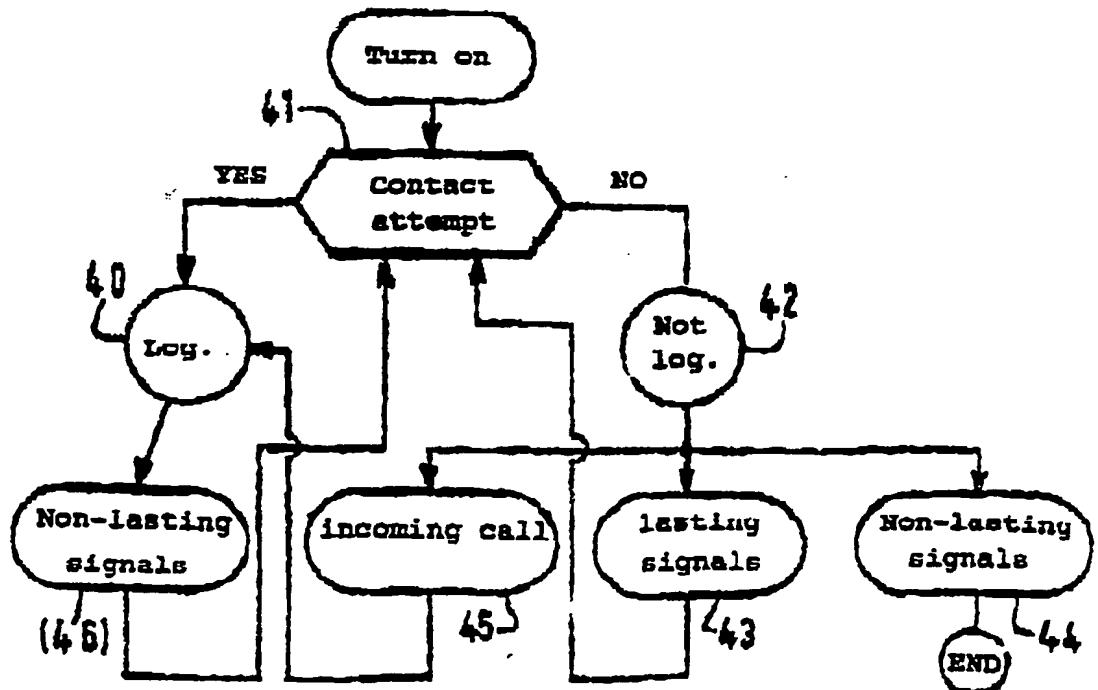


FIG.7

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MOBILE RADIOTELEPHONY METHOD AND  
MOBILE RADIOTELEPHONE TERMINAL

The present invention relates to mobile radio-  
5 telephony. Hitherto, two solutions have been proposed:  
cellular telephony and local telephony.

Cellular telephony

A cellular telephony network, interconnected  
with the ordinary telephone network, includes a  
10 terrestrial structure, or infrastructure, consisting of  
a collection of switching centres, each of which manages  
a collection of base stations, or radio ports, which are  
linked to it. In the GSM (Groupe Spécial Mobile) network,  
a base station BTS (Base Transceiver Station) is linked  
15 to a mobile switching centre MSC by way of a base  
controller BSC (Base Site Controller) common to several  
base stations, and likewise an MSC switching centre can  
be common to several BSC controllers. Other known  
cellular telephony networks, include the GSM 1800  
20 network, the Radiocom 2000 network and the SFR (Société  
française de radiotéléphone) line network.

The radio ports are the centres of a collection  
of cells which, as far as the territory of France is  
concerned, are essentially adjoining and cover the whole  
25 of the territory.

The user of a cellular telephony network, owning a terminal, or mobile telephone set, is fully able to travel around. He is tracked automatically by a switching centre which knows which cell he is in so as to 5 be able to route incoming calls to him. This is the locating function of such a network, implemented by means of various procedures.

The range of the base stations is fairly large and, clearly, the radio frequencies of two neighbouring 10 cells, and sometimes even of two which are several cells apart, must be different in order to avoid interference.

As a result of this requirement of frequencies and of the locating procedures, which burden the spectral budget, the operation of a cellular telephony network is 15 expensive, although it may offer the advantage of the mobility of the subscribers.

#### Local telephony

A local telephony network, also interconnected with the ordinary telephone network, includes a collection 20 of management centres (CG), each linked to a collection of port attachment units (URB), each linked to a group of radio ports. These ports are installed in public places (railway stations, major road junctions, etc.) or private places (factories, homes, etc.).

25 Known Local telephony networks, include the POINTEL/CT2 second generation cordless radiotelephony

network, and the DECT (Digital European Cordless Telephone) network. The initials CG and URB mentioned above are in fact those of the POINTEL network. The range of the ports is very low, of the order of about a hundred 5 metres and the users are able to use their mobile terminal only local to a port. The whole of the territory is far from covered; vast areas are not. Local telephony offers a service inferior to that of cellular telephony. It was created because cellular telephony could not meet 10 demand given the few available frequencies and the traffic to be satisfied.

A local telephony network does not afford any permanent locating function. When a user intends to remain local to a port for some time, he can, through a 15 manual action and a so-called logging procedure, make himself known to the port and request the routing of the incoming calls which are addressed to him. In practice, in the POINTEL network, the logging is performed at the attachment unit which controls the port, the relevant 20 management centre being informed thereof.

Local telephony has therefore opted for a small number of frequency channels since there is no interference between one port and the next, thus allowing 25 low-cost operation, but with the disadvantages of small territorial coverage and the restriction of remaining local to a port.

In short, cellular telephony and local

telephony both have advantages and disadvantages.

The present invention aims to propose a mobile telephony method which may combine, according to the circumstances, the advantages of both methods, cellular  
5 and local telephony.

For this purpose, the present invention relates firstly to a mobile radiotelephony method for routing calls between an ordinary telephone network and a plurality of subscriber mobile telephone terminals, wherein  
10 the routing of the calls can be performed either by way of cellular telephony ports or of local telephony ports and that, in the event of an outgoing call from a user terminal, contact is firstly sought with a local telephony port, if it is accepted, it is proposed to make  
15 the call under local telephony and the user has the choice between validation of the proposal, refusal thereof, in order to make the call under cellular telephony, or cancellation of the call.

Naturally, and preferably, if no contact is  
20 accepted by a local telephony port, it is proposed to make the call under cellular telephony and the user has the choice between accepting to make the call under cellular telephony or cancelling the call.

The method of the invention is therefore a  
25 mixed cellular and local method, according to the flow chart of Figure 1, which offers the great advantage to a user of communicating at the best cost depending on the

circumstances, by using one or the other of the two networks, but while seeking to initiate an outgoing call under local telephony, the least expensive solution, and under cellular telephony, only by default.

5 Local to a local (telephony) port, he will be able to use it if he has no intention of moving; otherwise, he will go through the cellular (telephony) network.

It will be noted that the proposal to route an  
10 outgoing call from a terminal via a local port can be performed in both a visual or auditory manner.

In an advantageous implementation of the method of the invention, it is also possible, and alternatively, to choose the mode of telephony automatically as a  
15 function of the availability of the frequency channels and under the control of the subscriber, who may, or may not, confirm the chosen mode, for example by actuation of a key or other equivalent command.

It will be noted that in the event of interchangeable manual or automatic operation, it is preferable to select a priori the simplest and least expensive operation, that is to say manual operation. If the user is near a local port, he will therefore choose the local telephony mode whilst accepting being cut off from  
25 the cellular telephony network, and vice versa. For certain categories of users, this is perfectly adequate: they may be users who make only outgoing calls, those

whose usage of time is sliced up routinely and who, for example, will call upon the local network at their home and at their office and the cellular network between their home and their office.

5           In the event of an incoming call on a terminal, a priori in cellular mode unless the user has "logged" into a local port, the mode of the call is indicated to the user of the terminal so that he can accept it in full knowledge, or possibly refuse it and, especially, indicate to him, if the local mode is involved, that he  
10          should not move too far away.

With regard to the incoming calls, it is in fact preferable to undertake radio monitoring and to periodically and alternately scan the channels of the  
15          cellular network and those of the local network, by virtue of the fact that the current procedures for mobile telephony, be it cellular telephony or local telephony, permit discrete and non-continuous monitoring, without event loss.

20           Preferably, if, in a listening phase in one of the two modes, a pertinent event occurs (incoming or outgoing call) in the relevant listening mode, the terminal, under single-mode management, then automatically toggles into the relevant mode and any event  
25          arising thereafter in the other of the two modes will be masked until the return to monitoring.

Monitoring is not at all incompatible with the

logging procedure of local telephony. However, if a user had logged into a local port and if his terminal has toggled into cellular mode, any incoming call presented subsequently by the local port may be masked.

5 Advantageously, at the end of a communication in one of the two modes and before the return to monitoring, and according to the flow chart of Figure 2, it having been possible for the masked network of the other of the two modes, during the communication, to  
10 assume that the terminal was not working, the terminal becomes logged into this masked network through the appropriate procedure, namely the POINTEL local telephony logging procedure and the IMSI (International Mobile Subscriber Identity) ATTACH procedure under GSM cellular  
15 telephony.

It may also be advantageous for the two communications in the two modes, cellular and local, to have two-way management, as for example in ISDN man-machine interactions. When a communication is in  
20 progress in one mode, a terminal, more elaborate in this case, remains in radio contact on the other mode. This enables it, on the one hand, to pick up an incoming call in the other mode and, on the other hand, to not risk losing its logging in the other mode. If therefore an  
25 incoming call arrives in the other mode, the user can take it while putting the communication in progress on hold so as to resume it afterwards, and so on. This

involves simultaneous, or dual-mode management, in contrast to the single-mode management mentioned earlier in connection with radio monitoring and the toggling of the terminal into a mode, the monitoring, for its part, 5 always remaining dual-mode.

The objective of using the local telephony network, in preference to the cellular telephony network, is relatively easy to achieve with the outgoing calls. However, as far as the incoming calls are concerned, 10 their mode may be a priori left to the initiative of the calling party who dials either a cellular telephony number or a local telephony number, which differ from one another.

Advantageously, the invention further makes 15 provision for assigning to a mobile terminal just a single telephone number and for letting the infrastructures of the two networks route an incoming call via one of the two networks, depending on the circumstances, but with a preference for the local 20 telephony network.

This is achieved by linking at least one switching centre of the cellular network to at least one management centre of the local network via an inter-structure link, by rendering systematic, and preferably 25 automatic, the local telephony logging procedure and by regarding a mixed cellular and local subscriber, firstly as a subscriber to the local network, so that any incom-

ing call from a calling party reaches the local network management centre.

With reference to the flow chart of Figure 3, if the subscriber has logged into an attachment unit, the 5 management centre directs the incoming call there, before the communication is established. In the contrary case, the local network management centre, by way of the interstructure link, interrogates the cellular network which may confirm that the subscriber exists and has been 10 located, in which case the call is then transferred to the subscriber's base station and the communication is established. In the contrary case, the call is cancelled.

As a variant, the management centre could possess a copy of the table of subscribers to the 15 cellular network and, instead of interrogating the cellular network, in the event of a subscriber not featuring in the table, the local network management centre could transfer the call directly to the cellular network base station, the interstructure link now serving 20 only for the updating of the table.

The invention also relates to a subscriber mobile telephone terminal for the implementation of the telephony method, such as claimed above, comprising an antenna, a radio stage, a baseband stage, a central 25 processing unit and a collection of application elements, wherein the central processing unit is configured for two-way management of the two modes, cellular and local.

Preferably, the central processing unit is configured in order to:

- afford radio monitoring and periodic and alternate listening to the channels of the two networks,
- 5 - execute automatic logging procedures,
- capture local telephony signals.

Advantageously, a mixer stage is provided, in order to afford separation of the cellular telephony tracks and of the local telephony tracks, the radio stage 10 includes a transmitter/receiver for local telephony and a transmitter and a receiver for cellular telephony.

The invention will be understood even more clearly with the aid of the following description of several embodiments of the subscriber mobile radio-15 telephone terminal, with reference to the attached drawing in which:

- Figure 1 represents a flow chart of steps for processing the outgoing calls of the method of the invention;
- 20 - Figure 2 represents a flow chart of steps for processing incoming calls, through radio monitoring, of the method of the invention;
- Figure 3 represents a flow chart of steps for automatic routing of the incoming calls of the method of 25 the invention;
- Figure 4 represents a diagrammatic organisation of the mixed cellular telephony and local telephony

- infrastructure within which the terminal of the invention can be developed;
- Figure 5 represents the diagrammatic structure of the embodiment of the terminal with simultaneous operation;
  - Figure 6 represents the diagrammatic structure of the embodiment of the terminal with single-mode operation and
  - Figure 7 represents a flow chart of the automatic logging procedure.

The terminal (radiotelephone) of the invention which will be described is configured in order to be developed within a mixed cellular telephony and local telephony infrastructure 1, in this instance, and merely by way of example, a GSM network 2 and CT2 Pointel network 3 infrastructure.

The GSM network 2 is interconnected to the RTC ordinary switched telephone network 4 by one or more MSC centres 5 each controlling a collection of BSC controllers 6 each of which in turn controls a collection of BTS stations 7 with which the terminal can communicate directly.

The Pointel network 3 is interconnected to the RTC network 4 by one or more management centres 8 each controlling a collection of attachment units 9 each of which in turn controls a collection of ports 10 with which the terminal can communicate directly.

The two networks, GSM 2 and Pointel 3, are interconnected directly together via a link 11, here of type X25, between a switching centre 5 and a management centre 8. As a variant, the two centres 5 and 8 could be  
5 integrated into a single centre.

It was seen that such an interstructure link enabled the subscriber terminal to respond to just one mixed call number and to let the infrastructure route the incoming calls preferably via the Pointel network 3,  
10 depending on the circumstances.

With reference to Figure 5, the subscriber terminal 12 includes an antenna 13, a mixer stage 14, a radio stage 15, a baseband stage 16, a central processing unit 17 and a collection of application elements 18, the  
15 whole being supplied by a battery 19.

The antenna 13 is common to the two modes, cellular telephony and local telephony, by virtue of the closeness of the GSM and Pointel frequencies. It is an antenna for the 864-960 MHz frequency band. Similarly, an  
20 antenna for the 1800 MHz frequency can also be common to the two modes GSM 1800 and DECT.

The mixer stage 14 affords separation of the GSM and Pointel tracks and drives the radio stage. It comprises three filters, a first 20, for the Pointel  
25 track, for the 864-868 MHz band, a second 21, for the transmission of the GSM track, for the 890-915 MHz band, and a third 22, for the reception of the GSM track, for

the 935-960 MHz band.

The radio stage 15 includes a Pointel transmitter/receiver 23, a GSM transmitter 24 and a GSM receiver 25.

5 In the GSM mode, the communications are duplexed with one frequency for transmission and another for reception whilst in the Pointel mode, they are time-division duplexed on a single frequency.

10 The baseband stage 16, with a Pointel circuit 26 and a GSM circuit 27, affords a two-fold function. On transmission, they translate the information to be transmitted which is delivered by the central processing unit 17, into frames defined by the CT2 and GSM standards intended for modulating the transmitters 23, 24. On 15 reception, they extract the frames received by the receivers 23, 25 and translate them into information and events usable by the central processing unit 17.

As application elements, linked to the central processing unit 17, there are a digitising/dedigitising 20 circuit 28, a sound maker 29, a display 30, a keyboard 31 and a "mode" key 32.

The central processing unit 17 manages and controls the application elements 28-32, manages the CT2 and GSM procedures and affords coordination of the two 25 modes, cellular and local, as illustrated in particular by the flow charts of Figures 1-3.

The display 30, the keyboard 31, the mode key

32 and the sound maker 29 form a subscriber/terminal interface common to both modes.

The central processing unit here affords the compression/decompression of the voice from or to the 5 digitised form of the signal of a microphone or loud-speaker attached to the circuit 28.

As a variant, it will be noted that the compression/decompression could also be afforded by a separate circuit, unless there is no provision therefor 10 if the networks transmit analog sounds.

It was seen above that two communications in the two modes, CT2 and GSM, could be managed in two-way fashion or simultaneously. It is the central processing unit 17 which then manages the two tracks simultaneously 15 in accordance with the CT2 and GSM procedures. When quiescent, the central processing unit 17 gathers, on the GSM track, indications about the power received in particular from the closest base station 7 and responds to its summonings (incoming calls). Similarly, as far as 20 the CT2 track is concerned, the central processing unit 17 scans the channels while searching also for the incoming calls.

It was also seen above that the management could be single-mode only, through radio monitoring and 25 periodic and alternate listening to the channels of the two networks.

In this case, the two tracks, such as presented

earlier, can be maintained in the terminal but, as a variant, and with cost-reduction in mind, it is possible to retain just a single track common to the two modes, without a mixer stage and with a common radio stage 15' 5 and a common baseband stage 16' (Figure 6).

It will be recalled here that the choice of cellular or local telephony mode can be performed automatically or manually, by actuation of the mode key 32. Even in the event of manual selection, the central 10 processing unit continues to offer the advantage of its common ergonomics.

Generally, when a subscriber plans to remain local to a port 10 of the Pointel network 3, he triggers the logging procedure manually.

15 It was seen earlier that in single-mode operation, before the return to monitoring, and at the end of a communication in cellular mode, the terminal is automatically logged into the local network.

It was also seen that, in the case of an automatic routing of incoming calls with a preference for the 20 local network, the logging procedure was systematic.

This automatic logging procedure, irrespective of mode, is implemented by virtue of the central processing unit 17.

25 With reference to the flow chart of Figure 7, once turned on, the central processing unit 17 of the terminal 12 scans for the presence of Pointel signals,

which are or are not addressed to it (near a Pointel port 10 the telephone traffic is rarely nil). As long as the central processing unit 17 captures such signals, it is assumed that the subscriber is local to a port 10 and 5 that the latest logging of the subscriber is still valid (40).

If the Pointel signals disappear for a specified duration (46), for example one minute, an attempt at contact with the port is made by the central 10 processing unit (41). In the event of failure, the terminal assumes that the logging is potentially deleted (42).

In the latter case, the central processing unit 17 starts to listen for new Pointel signals. If new 15 Pointel signals reappear in a lasting manner (43), for example for one minute, a logging attempt is made (41).

In the event of non-lasting reappearance (44), the automatic logging procedure, being inopportune (the subscriber may pass in front of a port on board a car, 20 for example), is not attempted.

If the central processing unit 17 captures Pointel signals relating to the terminal 12 and indicating that logging has not been lost, through reception of an incoming call for example (45), the central processing 25 unit returns directly to the logged state (40).

CLAIMS

1. Mobile radiotelephony method for routing calls between an ordinary telephone network and a plurality of subscriber mobile telephone terminals, wherein the routing of the calls can be performed either by way of ports of a cellular telephony network or by ports of a local telephony network and that, in the event of an outgoing call from a user terminal, contact is firstly sought with a local telephony port and if it is accepted a proposal is made to make the call under local telephony and the user has the choice between validation of the proposal, refusal thereof in order to make the call under cellular telephony, or cancellation of the call.
2. Method according to Claim 1, in which, if no contact is accepted by a local telephony port, it is proposed to make the outgoing call under cellular telephony and the user has the choice between accepting to make the call under cellular telephony or cancelling the call.
3. Method according to either of Claims 1 and 2, in which it is possible to choose the mode of telephony automatically as a function of the availability of the frequency channels and under the control of the subscriber.

4. Method according to Claim 3, in which, when the subscriber is near a local port, he selects the local telephony mode manually.
5. Method according to one of Claims 1 to 4, in which the mode of a call is indicated to the subscriber in order to be able to accept it in full knowledge.
6. Method according to one of Claims 1 to 5, in which it is possible to proceed to radio monitoring of and periodic and alternate listening to the channels of the cellular network and to the channels of the local network.
7. Method according to Claim 6, in which, if in a listening phase and under single-mode management, a pertinent event occurs in the relevant listening mode, the subscriber terminal automatically toggles into the relevant mode.
8. Method according to either of Claims 6 and 7, in which, at the end of a communication in one of the two modes and before the return to monitoring, the subscriber terminal is logged into the network of the other of the two modes.
9. Method according to one of Claims 1 to 8, in

which, when a communication is in progress in one of the two modes, local telephony or cellular telephony, radio contact is maintained on the other mode.

10. Method according to one of Claims 1 to 9, in  
5 which the cellular network and the local network are linked.

11. Method according to Claim 10, in which, if a subscriber is logged into the local network, an incoming call is directed to the subscriber through the local  
10 network and, otherwise, the local network interrogates the cellular network.

12. Method according to Claim 10, in which a table of subscribers to the cellular network is updated in the local network.

15 13. Mobile telephone terminal comprising an antenna, a radio stage, a baseband stage, a central processing unit and a collection of application elements, wherein the central processing unit is configured for use of both a cellular and local telephony network.

20 14. Terminal according to Claim 13, in which the central processing unit is configured in order to afford radio monitoring and periodic and alternate listening to

the channels of the two networks.

15. Terminal according to either of Claims 13 and 14, in which the radio stage and baseband stage are common to the two modes.

5 16. Terminal according to either of Claims 13 and 14, in which a mixer stage is provided, in order to afford separation of the cellular telephony tracks and of the local telephony tracks, the radio stage includes a transmitter/receiver for local telephony and a  
10 transmitter and a receiver for cellular telephony.

17. Terminal according to one of Claims 13 to 16, in which the central processing unit is configured in order to execute automatic logging procedures.

18. Terminal according to Claim 17, in which the  
15 central processing unit is configured in order to capture local telephony signals.

19. A mobile telephone terminal substantially as any one embodiment herein described with reference to the accompanying drawings.

20. A mobile radio telephony method substantially as any one embodiment herein described with reference to the accompanying drawings.

Patents Act 1977  
Examiner's report to the Comptroller under Section 17  
(ie Search report)

-22-

Application number  
GB 9314915.1

Relevant Technical Fields

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H4K KY4D14, KY4D14R, KYX

(ii) Int Cl (Ed.5) H04Q 7/00, 7/04; H04B 7/26

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) On-line database : WPI

Search Examiner  
JOHN CAGE

Date of completion of Search  
12 October 1993

Documents considered relevant following a search in respect of Claims :-  
1-20

Categories of documents

X: Document indicating lack of novelty or of inventive step.

P: Document published on or after the declared priority date but before the filing date of the present application.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

A: Document indicating technological background and/or state of the art.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2225512 A (MOTOROLA) see Figures 1, 2, 5, 7 and page 10 lines 5-33	1,5,6,7,9,10,13,14,17,18
X,P	WPI Accession No 93-190646/24 and JP 5-91017 (MATSUHITA) see abstract	13
X,P	WPI Accession No 93 -106611/13 and JP 5-48526 (MATSUMITA) see abstract	13

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